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2000 ERDC MSRC PET Training Activities

by

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1 Introduction

This report summarizes the training activities conducted through the Programming Environment and Training (PET) program at the U.S. Army Engineer Research and Development Center (ERDC) Major Shared Resource Center (MSRC) for the 2000 calendar year. These activities were organized by the PET on-site staff, in collaboration with members of the PET university team, to provide training courses, workshops, and seminars to the ERDC MSRC user community. Similar reports were produced for the years of 1997 [1], 1998 [2], and 1999 [3].

The PET training program encompasses a broad range of activities and topics, but the main emphasis is on training directed toward specific High Performance Computing (HPC) architectures and those Computational Technology Areas (CTAs) supported by the ERDC MSRC. This year there were training courses on all three platforms, the SGI Origin 2000/3000, the Cray T3E, and the IBM Power3 SMP. These training courses are a quick, cost-effective means of getting new users up and running at the ERDC MSRC. Ohio Supercomputer Center (OSC) continues to be the major supplier of PET training in this area and their experiences and recommendations are discussed in a PET Technical Report [4].

During the first half of the year, efforts in distance education and training continued to be directed toward the application of Tango Interactive. The principle achievement with Tango was the offering of a graduate level course from Syracuse University to the ERDC MSRC. This was the first time Tango has been used to provide a distance education course for graduate credit to ERDC MSRC users. Recent activities with Tango are documented in a PET Technical Report [5]. The second half of the year was a period of experimentation with commercial web conferencing tools and services and the Polycom Stream Station, that was installed at the ERDC MSRC.

2 Training Courses

PET training is designed to assist the DoD scientists and engineers in efficiently using the present and future HPC hardware acquired under the High Performance Computing Modernization Program. The training curriculum is a living document with new topics being added continually to keep up with the fast pace of research and development in the field of computational science and engineering. The curriculum contains courses in the following general categories:

- Parallel programming
- Architecture and software specific topics
- Visualization and performance
- CTA targeted classes, workshops, and forums

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Table 1 gives a list of all classes taught during 2000 with the number of students attending each class. The following totals are generated from the table:

- Number of courses: 18
- Number of students from remote sites: 50
- Number of students: 189

Date	Course	No. of Students (Remote)
Jan. 11-12	Multiphysics Workshop	30(16)
Jan. 13-14	Grid Generation	12(1)
Jan. 25-28	AVS/Express	5(1)
Feb. 1-2	Hierarchical Data Format (HDF5)	11(1)
Feb. 8-9	JSU Visualization Workshop [1]	12(12)
Feb. 28-29	Using the SGI Origin 2000 [2]	8(3)
Mar. 1	Parallel Programming using OpenMP [2]	11(2)
Mar. 15-16	Hierarchical Data Format (HDF5) [2]	3(3)
Mar. 30-31	Mesoscale Atmospheric Models	12(3)
May 9	Lectures in CFD [2]	14(7)
May 31	Quantitative Performance Analysis and PAPI	7(0)
July 26-27	Parallel Debugging and Performance Analysis Tools	7(0)
Aug. 22-24	IBM Power3 SMP Systems	13(0)
Sep. 26-27	Using the SGI Origin Systems [3]	9(1)
Oct. 30-31	Using the Cray T3E [3]	4(0)
Nov. 13	Reactive Transport Problems	14(0)
Nov. 13-17	SHAMRC Users Course	7(0)
Nov. 21	Pthreads Tutorial	10(0)

[1] Held at Jackson State University
[2]Tango broadcast to remote sites
[3] Polycom Stream Station broadcast to remote users

Table 1: Courses taught from January through December 2000

In Table 1, the term "remote student" refers both to students from remote sites who traveled to the ERDC MSRC to attend a training course and to students at remote sites who received a broadcast of a training course from the ERDC MSRC.

This year three training courses were broadcast over the internet using Tango. The Tango system was phased out at midyear in favor of the Polycom Stream Station. The Stream Station lacks the two-way communication of Tango, but tends to be more reliable and easier to use by both instructor and students. The two courses broadcast with the Stream Station were taught by instructors from OSC. OSC was involved for the beginning of the PET program with MBONE and Tango and continues to collaborate with the on-site training team on the investigation of new technology for remote training and distance education.

Training material is available for most courses and selected courses are recorded on VHS tapes. Information on availability of material and tapes may be obtained from ERDC MSRC Customer Assistance Center by email at info-hpc@wes.hpc.mil or phone at 601-634-4400 (option 1) or 1-800-500-HPCC. Descriptions for all training courses offered in 2000 appear in Appendix A.

3 Conference Tutorials

The PET team was active in teaching tutorials at professional meetings. These events were sponsored by the conference organizer and disseminated knowledge not only to the ERDC MSRC users, but also to the larger HPC user community. Dr. Clay Breshears and Dr. Henry Gabb of the PET on-site team taught a tutorial on "Concurrent Programming with Pthreads" at the DoD HPC Users Group Conference in Albuquerque, NM, on June 5, 2000. At the same conference, Dr. Breshears and PET personnel from the Army Research Laboratory (ARL) and the Aeronautical Systems Center (ASC) taught a tutorial, "Tools and Techniques for OpenMP, MPI, and Mixed OpenMP and MPI Parallel Programming." Dr. Graham Carey, CSM Academic Lead at the University of Texas at Austin, delivered a short course on "Adaptive Mesh Generation" at the 9th International Meshing Roundtable in New Orleans on October 2, 2000.

4 Seminars

The PET program offers seminars on an irregular basis. These are presentations by experts in their field and are designed to introduce the ERDC MSRC users to current research topics in HPC. Table 2 gives a list of seminar presentations during 2000.

Date	Seminar Title
Feb. 14	Meshless Methods in Computational Structural Mechanics
Feb. 22	Numerical Simulation of Nearshore Shallow Waves using the SWAN Code
Sept. 12	Description and Applications of the FEFLO Solver for Solution of the Unsteady Navier-Stokes Equations
Sept. 18	Emerging Standards for Training and Education from the DoD and the IMS Consortium [1]
Oct. 4	Using MPI-I/O
Oct. 6	Recent Developments in Research on Adaptive and Unstructured Grids

[1]Webcast from FSU using the CENTRA Web Conferencing Service

Table 2: Seminar presentations for January through December 2000

Abstracts of seminar presentations appear in Appendix B.

5 Distance Education

This year brought to a conclusion the 3-year experiment on the PET team with the Tango Interactive collaboratory system. During the Spring 2000 semester, the distance education course "Computational Science for Simulation Applications" was delivered by Syracuse University to students at Jackson State University, Morgan State University, Naval Oceanographic Office (NAVO), Naval Research Laboratory (NRL), and the ERDC MSRC. ERDC students received three semester hours of graduate credit from Mississippi State University through the auspices of the ERDC Graduate Institute. A course description is included in Appendix C. The course number is that assigned by Syracuse University.

6 Conclusions

The PET training program will continue to evolve to meet the training and education needs of the ERDC MSRC users. While the architecture of HPC systems has changed little over the last few years, and little change is expected in the immediate future, the field of information technology continues

to change at a rapid rate. The growing presence of the web will effect how ERDC MSRC users compute in the future. The location of data, programs, and host machines will be less important, while information management will become a greater problem. One of the goals in the PET program will be to provide the training that users need to compute in future distributed environments. The HPC resources may not change, but the user may access these resources using practically any device with an internet connection, from a high-end workstation down to a PDA. Thus, the PET program will continue to evolve as it has from the beginning. Evidence of this evolution may be seen by comparing the training activities in this report with those of the reports of 1997, 1998, and 1999 activities, [1], [2], and [3].

The scheduling of training courses and other events is coordinated with the MSRCs at ARL, ASC, and NAVO. The current schedule of ERDC MSRC training courses is on the web at `http://www.wes.hpc.mil/training/schedule/schedule.htm`. Suggestions for future training are always welcome and can be made by contacting Wayne Mastin by email at mastin@wes.hpc.mil or by phone at 601-634-3063. The PET training staff is also available to provide facilities and technical support for ERDC MSRC user sponsored training events, meetings, and workshops.

References

[1] Wayne Mastin, "1997 CEWES MSRC PET Training Activities," CEWES MSRC PET TR 98-01, Vicksburg, MS, 1998.

[2] Wayne Mastin, "1998 CEWES MSRC PET Training Activities," CEWES MSRC PET TR 99-08, Vicksburg, MS, 1999.

[3] Wayne Mastin, "1999 ERDC MSRC PET Training Activities," ERDC MSRC PET TR 00-05, Vicksburg, MS, 2000.

[4] Troy Baer, David Ennis, Leslie Southern, "HPC Training Courses at ERDC MSRC Provided by the Ohio Supercomputer Center," ERDC MSRC PET TR 00-19, Vicksburg, MS, 2000.

[5] David E. Bernholdt, Geoffrey C. Fox, Nancy J. McCracken, Roman Markowski and Marek Podgorny, "Reflections on Three Years of Network-Based Distance Education," ERDC MSRC PET TR 00-26, Vicksburg, MS, 2000.

A Training Courses

Multiphysics Problems

TITLE: Coupling Multiphysics Problems in Environmental Simulation

INSTRUCTORS: Mary Wheeler, University of Texas at Austin and Phu Luong, ERDC MSRC

INSTRUCTION MODE: Lecture and discussion

DURATION: 2 days

TARGET AUDIENCE: Users and developers of codes for the simulation of physical processes

PREREQUISITES: Basic knowledge of numerical methods and simulation

OVERVIEW: Modeling of the environment is by nature a multidiscipinary problem requiring the simulation of a number of physical phenomena. The solution of large-scale environmental quality problems requires coupling of physical models and the resources of high performance computing. This workshop focuses on mathematical and computational issues in coupling different physical models and simulators.

Grid Generation

TITLE: Computational Grids: Generation, Adaptation, and Solution Strategies

INSTRUCTOR: Graham F. Carey, University of Texas at Austin

INSTRUCTION MODE: Lecture

DURATION: 2 days

TARGET AUDIENCE: Computational scientists and engineers needing to generate grids for numerical simulations

PREREQUISITES: Basic concepts in numerical solution of partial differential equations

OVERVIEW: This course begins with a brief discussion of the basic concepts of structured and unstructured grid generation. Grid refinement strategies are then introduced along with the error estimators and error indicators that are used to guide the refinement process. The idea of interweaving grid refinement with the solution iteration is also introduced. The last part of the course covers selected topics on multilevel methods, domain decomposition, mesh redistribution, and moving grids.

The material for this training course is based on Prof. Carey's book "Computational Grids: Generation, Adaptations, and Solution Strategies," published by Taylor and Francis, 1997.

Advanced Visual Systems (AVS)

TITLE: Introduction to AVS/Express

INSTRUCTOR: Laura Webb, AVS, Inc.

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 4 days

TARGET AUDIENCE: Applications Developers and Users of AVS/Express or AVS/Express Applications

PREREQUISITES: C programming experience for laboratory exercises on the last day

OVERVIEW: Introduction to AVS/Express is a 4-day course appropriate for both the Visualization Edition and the Developer Edition AVS/Express users. The course material is designed to make students comfortable in the development environment, provide a comprehensive overview of the capabilities, built-in objects and programming paradigm of AVS/Express, and introduce the user to the program extension facilities available in AVS/Express. Upon completion of this course, students possess the skills necessary to effectively build significant prototypes and basic applications and also come away with the breadth of product knowledge needed to investigate and understand additional tool capabilities.

Hierarchical Data Format

TITLE: A Course on HDF5

INSTRUCTOR: Mike Folk, NCSA, University of Illinois at Urbana-Champaign

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: The course is tailored to students who have an interest in HDF5 and have programming experience. Examples and laboratory problems are presented in Fortran, but C versions are also available.

PREREQUISITES: Programming experience in Fortran and/or C

OVERVIEW: Learn the basics of HDF5, using Fortran 90 programming examples.

HDF is an I/O library for storing and manipulating very large scientific data sets. The most recent version, HDF5, is designed to work well in high performance environments. It supports parallel I/O using MPI-IO, can store very large datasets, and provides flexible, powerful subsetting operations. There are plans to make it thread-safe in the coming year. HDF5 is a new format and library, different from the current version of HDF. Fortran, C, and Java APIs are currently available. HDF5 is expected to supercede the old HDF format, which is used by many commercial software packages, particularly for scientific visualization.

JSU Visualization Workshop

TITLE: JSU Visualization Workshop

INSTRUCTOR: Chuck Patrick, Jackson State University

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: Students and faculty at JSU and other regional HBCU/MI institutions

PREREQUISITES: An interest in scientific visualization and computing

OVERVIEW: The purpose of this workshop is to introduce and educate researchers, students, faculty, and staff to the importance of visualization and to show how visualization can be used in any field of study. Various topics in scientific visualization are discussed and participants are required to conduct hands-on practical exercises in the lab.

SGI Origin 2000

TITLE: Using the SGI Origin 2000 for Code Development and Analysis

INSTRUCTOR: David Ennis, Ohio Supercomputer Center

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: Applications developers and users of the SGI Origin 2000

PREREQUISITES: Users should be familiar with high-level programming languages (Fortran, C).

OVERVIEW: This "how-to" workshop is designed to train the participants in the techniques and tools required to perform parallel programming on the SGI Origin 2000 (O2K). After a discussion of the MIPS R10000 processor, the O2K architecture, and an introduction to the IRIX operating system, topics such as creation and scheduling of parallel threads, compilers, programming environment, and diverse serial and parallel code analysis tools are discussed in detail along with examples of their use and sample output.

OpenMP

TITLE: Parallel Programming using OpenMP

INSTRUCTOR: David Ennis, Ohio Supercomputer Center

INSTRUCTION MODE: Lecture

DURATION: 1 day

TARGET AUDIENCE: Applications developers and users of HPC platforms with SMP nodes, such as the SGI Origin 2000 and the IBM Power3 SMP

PREREQUISITES: Participants should be familiar with high-level programming languages (FORTRAN, C).

OVERVIEW: OpenMP is becoming the de facto standard library for loop level parallelism directives and functions to make a code run in parallel. It is considered the easiest way to get started with parallel programming for newcomers since all data transfer between processors is hidden from the user and performed implicitly.

This course will cover the entire range of OpenMP capabilities from how to effectively make a loop run in parallel with an optimized distribution of iterations over the processors to more complex directives allowing entire sections of code to be run in parallel and (when needed) how to synchronize processors.

Atmospheric Modeling

TITLE: An Introduction to Mesoscale Atmospheric Modeling

INSTRUCTORS: Keith Bedford, Ohio State University, Richard Hodur, NRL Monterey, David Welsh, Ohio State University, Jordan Powers, National Center for Atmospheric Research, and Don Resio, ERDC CHL

INSTRUCTION MODE: Lecture

DURATION: 2 days

TARGET AUDIENCE: Users and deveopers of codes for atmospheric modeling

PREREQUISITES: Basic concepts in numerical simulation

OVERVIEW: Mesoscale atmoshperic modeling is used daily for weather forecasting, environmental studies, and the prediction of ocean and coastal wave conditions. Research and development areas include mesoscale four-dimensional data assimilation from satellites and conventional observations and the application of advanced numerical techniques to mesoscale modeling problems. This workshop is an introduction to mesoscale atmospheric modeling systems and the parameters used to model the mesoscale atmospheric processes and interactions between the atmosphere, ocean, and land surfaces. The main focus of the workshop is to introduce scientists to two of the most highly used codes for mesoscale atmospheric modeling, COAMPS and MM5.

CFD

TITLE: Lectures in Computational Fluid Dynamics

INSTRUCTORS: Bharat Soni, ERC, Mississippi State University, Michael Aftomis, NASA Ames Research Center, Paneer Selvam, University of Arkansas, Edward Luke, ERC, Mississippi State University, Nathan Prewitt, ERDC MSRC, and Robert Bernard, ERDC CHL

INSTRUCTION MODE: Lecture

DURATION: 1 day

TARGET AUDIENCE: Users and developers of CFD codes and algorithms

PREREQUISITES: Basic concepts in CFD

OVERVIEW: This 1-day series of lectures is designed to introduce new technology being developed for solving large-scale problems in computational fluid dynamics. The speakers discuss scalable CFD software available to the DoD, with an emphasis on the solution of problems on Cartesian and overlaid (Chimera) grid systems. Sample applications in aerodynamics and hydrodynamics are included.

Performance Analysis

TITLE: Quantitative Performance Analysis and the PAPI Library

INSTRUCTOR: Philip J. Mucci, University of Tennessee, Knoxville, and IBM Research, Yorktown Heights, NY

INSTRUCTION MODE: Lecture and hands-on lab session

DURATION: 1 day

TARGET AUDIENCE: IBM SP, Cray T3E, and SGI Origin applications programmers

PREREQUISITES: Programming experience on HPC machines

OVERVIEW: It has been shown that on MPPs, acceptable performance of large classes of application codes is only achieved through significant single processor optimization. As the caches get larger and interconnect speeds increase, so does the processors demand for data in bigger and more detailed applications. Thus the need for performance tools and more importantly, accurate performance data has never been greater.

This tutorial introduces the PAPI Library and related performance tools. PAPI is a library that allows one to access the hardware performance counters that exist on most modern CPUs, including those in the IBM SP, the Cray T3E and the SGI Origin 2000s. These counters allow the user to measure events internal to the processors function (for example, cache misses, memory references, floating point instructions, and stall cycles). When analyzed, these events and their relationships often indicated poorly structured code. More importantly, these events hint at "why" and thus implicitly point to the remedy. This course first covers the basic processor architecture of each of the above systems. Then, the basic library calls of PAPI are covered as directly related to application developers. Finally, the various commercial and free tools built on top of PAPI are covered, including SvPablo from the University of Illinois, TAU from the University of Oregon, and DEEP/MPI from Pacific Sierra Research. Any time left is spent working with users on specific performance problems.

Parallel Tools

TITLE: Parallel Debugging and Performance Analysis Tools

INSTRUCTOR: Clay Breshears, ERDC MSRC

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: Developers of application codes on ERDC MSRC HPC systems

PREREQUISITES: Some parallel programming experience

OVERVIEW: This tutorial covers the VAMPIR and VAMPIRtrace performance analysis tools on the first day and the TotalView debugger on the second day. Each day is a self-contained tutorial session. Rather than go through all lecture in the morning and then lab sessions in the afternoon, lab exercises are spread throughout the morning lecture sessions to work with features and topics as they are presented. In the afternoon sessions, any remaining lecture topics are covered. Also, students are encouraged to test out the tools on codes which they are currently working. The instructor is available for questions and other assistance.

IBM Power3 SMP

TITLE: Developing and Optimizing Scientific Applications on IBM Power3 SMP Systems

INSTRUCTORS: David Klepacki and Eric Myra, Advanced Computing Technology, IBM T.J. Watson Research Center

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 3 days

TARGET AUDIENCE: Developers of application codes on the IBM HPC systems

PREREQUISITES: Familiarity with Fortran and Unix

OVERVIEW: This workshop covers the latest hardware advancements (in particular, Power3 SMP nodes), uniprocessor performance optimizations, examples and comparisons of the available parallel programming models, and tools on IBM SP Systems. Users have an opportunity to work on optimization of their own codes during the afternoon sessions.

SGI Origin Systems

TITLE: Using the SGI Origin Systems at the ERDC MSRC

INSTRUCTOR: Troy Baer, Ohio Supercomputing Center

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: Applications developers and users of SGI Origin series computers

PREREQUISITES: Participants should be familiar with high-level programming languages (Fortran, C).

OVERVIEW: This "how-to" workshop is designed to train the participants in the techniques and tools required to perform parallel programming on the SGI Origin systems. After a discussion of the MIPS RISC processor, the Origin SMP architecture, and an introduction to the IRIX operating system, topics such as creation and scheduling of parallel threads, compilers, programming environment, and diverse serial and parallel code analysis tools are discussed in detail along with examples of their use and sample output. The workshop concludes with a brief overview of the new Origin 3000 architecture, which has recently been released by SGI.

Cray T3E

TITLE: Using the Cray T3E for Code Development and Analysis

INSTRUCTORS: David Ennis, Ohio Supercomputing Center

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 2 days

TARGET AUDIENCE: Applications developers and users of Cray T3E

PREREQUISITES: Users should be familiar with high-level programming language (Fortran, C). Experience with a message passing library (MPI, PVM, or Cray SHMEM) is helpful, but not necessary.

OVERVIEW: This "how-to" workshop is designed to train the participants in the techniques and tools required to perform parallel programming on the Cray T3E. Topics include a discussion of the DEC Alpha processor, the T3E architecture, the UNICOS/mk operating system and environment, program development tools, software libraries, single processor optimization techniques, and message passing library considerations.

Reactive Transport

TITLE: Reactive Transport Problems in Environmental Simulation

INSTRUCTORS: Mary F. Wheeler, University of Texas at Austin and Phu Luong, ERDC MSRC

INSTRUCTION MODE: Lecture

DURATION: 1 day

TARGET AUDIENCE: Developers and users of codes for environmental quality modeling and simulation

PREREQUISITES: Familiarity with methods of computational science and engineering

OVERVIEW: This workshop focuses on mathematical and computational issues in the solution of reactive transport problems. Participants are invited to present the results of their own work in this area. Topics include: 1) overview of reactive transport problems, 2) methods for advection-diffusion, 3) time stepping, and 4) chemistry.

SHAMRC

TITLE: SHAMRC User's Course

INSTRUCTORS: Charles E. Needham and Joseph E. Crepeau, Applied Research Associates, Inc.

INSTRUCTION MODE: Lecture and hands-on laboratory

DURATION: 5 days

TARGET AUDIENCE: CSM and CFD users of HPC resources

PREREQUISITES: Some familiarity with hydrocode calculations

OVERVIEW: SHAMRC (pronounced shamrock) is a two and three dimensional, finite difference, hydrodynamic computer code. SHAMRC, which stands for Second-order Hydrodynamic Automatic Mesh Refinement Code, is a descendant of SHARC (Second-order Hydrodynamic Advanced Research Code). It is used to solve a variety of airblast related problems, which include high explosive (HE) detonations, nuclear explosive (NE) detonations, structure loading, thermal effects on airblast, cloud rise, conventional munitions blast and fragmentation, shock tube phenomenology, dust and debris dispersion, and atmospheric shock propagation. The code has the capability to run with a single Eulerian grid or with the Automatic Mesh Refinement (AMR) option that divides the calculational domain into smaller Eulerian grids at several levels of refinement to provide high-resolution results. The 3D single-grid and the 2D and 3D AMR options can run serially or on parallel platforms using the MPI (Message Passing Interface) library.

Its capabilities and attributes also include multiple geometries, non-responsive structures, non-interactive and interactive particles, several atmosphere models, multi-materials, a large material library, HE detonations, a K-epsilon turbulence model, and water and dust vaporization. SHAMRC is second-order accurate in both space and time and is fully conservative of mass, momentum, and energy. It is fast because it employs a structured Eulerian grid and efficient due to the use of the pre-processor SRCLIB. SHAMRC is a production research code.

B Seminars

Meshless Methods

TITLE: Meshless Methods in Computational Structural Mechanics

SPEAKERS: Tinsley Oden, Graham Carey, and Armando Duarte, University of Texas at Austin

ABSTRACT: The term "meshless methods" encompasses a class of techniques striving to simplify the preparation of computational models by eliminating or reducing the effort dedicated to generation of classical finite element meshes. This includes a variety of methods, such as Generalized Finite Differences, Element-Free Galerkin, hp-Clouds, Wavelets, external approximation, R-functions, and others. While virtually all of these methods require some kind of discretization to solve the problem, typically generation of such a discretization lends itself to a high level of automation, allowing the user to perform meshless analysis. Besides simplifying model preparation, these methods are also advantageous in problems with changing domains, such as crack propagation, where classical finite element techniques experience difficulties in following the changing domain.

This seminar covers the theory of meshless methods, implementation issues, and a general overview of data structure concepts that apply to meshless methods and to other more standard techniques.

SWAN

TITLE: Numerical Simulation of Nearshore Shallow Waves using the SWAN Code

SPEAKER: Ijsbrand Haagsm, The Delft University of Technology, The Netherlands

ABSTRACT: One of the major challenges in ocean modeling is the accurate prediction of nearshore wave conditions during storms. The accurate predictions of nearshore wave properties is necessary for environmental impact studies of erosion and sediment transport as well as the potential need to evacuate residents living in coastal areas in the path of approaching storms. Accurate predictions play an equally important role in naval amphibious landing operations.

This seminar discusses the theory and application of the Simulating WAves Nearshore code (SWAN) developed at the Delft University of Technology. SWAN is designed for random, short-crested wind-generated waves in coastal regions and inland waters. Current and future developments are discussed.

FEFLO

TITLE: Description and Applications of the FEFLO Solver for Solution of the Unsteady Navier-Stokes Equations

SPEAKER: Ravi Ramamurti, Naval Research Laboratory, Washington, DC

ABSTRACT: FEFLO is a dynamically restructuring unstructured grid Navier-Stokes flow solver. The goal is to enable high fidelity computations of unsteady flowfields with complex geometries. The flowfield may contain moving bodies that could be accelerating with respect to design, engine, and propulsor technology. Unstructured grid technology has tremendous potential for addressing challenging CFD problems. This effort has been undertaken as part of a comprehensive DoD program to implement scalable computing technology in DoD laboratories, supported by the DoD Common HPC Software Support Initiative (CHSSI). The scalability, portability, quality assurance, visualization, and some applications of FEFLO are presented.

Training and Education Standards

TITLE: Emerging Standards for Training and Education from the DoD and the IMS Consortium

SPEAKER: Geoffrey C. Fox, Florida State University

ABSTRACT: The focus of recent efforts has been to define technical specifications for developers of course management systems and course content, so that products and services from the different distributed learning environments and multiple authors will work together. This presentation summarizes the standardization efforts underway in the DoD and the Instructional Management Systems (IMS) Global Learning Consortium, a consortium with members from educational, commercial, and government organizations. Of particular interest is the implications for the HPCMP PET program in the area of on-line systems and content for remote training and distance education.

NOTE: This seminar was broadcast as a web conference over the internet from Florida State University to the ERDC MSRC Training and Education Facility (TEF).

MPI-I/O

TITLE: Using MPI-I/O

SPEAKER: Dave Cronk, University of Tennessee, Knoxville

ABSTRACT: As processing speeds continue to increase at a rate far greater than that of disk I/O, I/O bandwidth is quickly becoming a major bottleneck for parallel applications with large data sets. This is particularly true for applications that perform frequent check-points or frequently write intermediate results. The use of traditional I/O in parallel applications introduces both programming complexities and performance inefficiencies. This seminar presents some of the programming complexities arising from the use of traditional I/O in parallel applications and also discusses why traditional approaches do not perform well. This is followed by the introduction of MPI-I/O as a means for getting improved I/O performance for parallel applications.

MPI-I/O is an extension to the MPI standard that allows parallel applications to take advantage of advanced parallel I/O techniques with a simple to use interface. This seminar introduces the MPI-I/O API and presents several examples of how this API can be used to both simplify programming and improve performance. This seminar is presented as an introduction to parallel I/O in general and MPI-I/O in particular. The target audience is users of high performance computing resources who would like to explore the possibility of using MPI-I/O to improve the I/O performance of their parallel code. At the conclusion of this seminar, attendees should have a basic understanding of the features of MPI-I/O and should have a general understanding of the potential advantages of using MPI-I/O. Furthermore, depending of the I/O characteristics of their code, some attendees should feel confident in their ability to use the information presented in this seminar, along with other reference material, to take advantage of the basic features of MPI-I/O to improve the I/O performance of their code.

Adaptive Grids

TITLE: Recent Developments in Research on Adaptive and Unstructured Grids

SPEAKER: Graham Carey, University of Texas at Austin

ABSTRACT: This seminar presents a survey on recent advances in adaptive grid generation technology applied to unstructured grids. It also includes a general discussion of error analysis, adaptive approaches, and aspects related to parallel computing such as partitioning.

C Distance Education

CPS 615 Computational Science for Simulation Applications

INSTRUCTOR: Geoffrey C. Fox, Florida State University

DATE: Spring Semester, 2000

METHOD OF DELIVERY: Tango from Syracuse University to Jackson State University, Morgan State University, NAVO, NRL, and the ERDC MSRC

PREREQUISITES: Computer programming experience

DESCRIPTION: This is a graduate level introductory course in the discipline of Computational Science (the computer simulation of natural systems). This course is designed to teach the basic tools from mathematics and computer science, which are needed to give computational solutions to scientific and engineering problems. Topics may include matrix methods, random numbers and Monte Carlo methods, numerical methods for ordinary and partial differential equations, and optimization techniques.